

Name of the Student: _____

Max. Marks : 23 Marks

Time : 23 Minutes

Q1.

A student does a series of reactions with aqueous solutions of some potassium halides (**P**, **Q** and **R**) of equal concentration. Each solution contains a different halide ion (chloride, bromide or iodide).

The student adds 3 drops of bromine water to 3 drops of each aqueous solution of potassium halide. The student also adds 3 drops of the bromine water to 3 drops of water.

Table 1 shows the student's observations.

Table 1

	Observation when 3 drops of bromine water are added
Solution P	Orange solution
Solution Q	Brown solution
Solution R	Orange solution
Water	Orange solution

- (a) Identify the halide ion present in **Q**.

Give the ionic equation for the reaction that occurs when bromine water is added to **Q**.

Halide ion in **Q**

Ionic equation

(2)

- (b) Explain, in terms of oxidising ability, why the observations from these reactions do **not** allow the student to identify the halide ion present in **P** and the halide ion present in **R**.

- (c) The student does a second experiment to determine the halide ion in each of **P** and **R**.

The student adds a few drops of aqueous silver nitrate solution to 2 cm³ of each potassium halide solution.

Table 2 shows the student's observations.

Table 2

	Student's Observation
P	Precipitate formed
R	Precipitate formed

Describe a further chemical test that the student can complete on the precipitates formed to identify the halide ion present in **P** and the halide ion present in **R**.

Describe how the observations from this test can be used to identify the halide ion present in **P** and the halide ion present in **R**.

(3)

(Total 7 marks)

Q2.

A student is provided with separate unlabelled samples of four different solutions for analysis.

The four solutions are known to be ammonium nitrate, potassium sulfate, sodium carbonate and magnesium nitrate, but the student does not know which sample is which.

Outline a series of test-tube reactions that the student can use to identify each of these solutions.

Include:

- the expected observations
- ionic equations for any reactions.

(Total 6 marks)

Q3.

This question is about chlorine.

- (a) Give an equation to show how chlorine forms an acidic solution in water.

(1)

- (b) Give an equation for the reaction between chlorine and cold, dilute aqueous sodium hydroxide.

(1)

- (c) In acidic conditions, ClO_3^- ions oxidise Cl^- ions to form Cl_2

Deduce a half-equation for the oxidation of Cl^- to Cl_2

Deduce a half-equation for the reduction of ClO_3^- to Cl_2

Deduce the overall equation for this reaction.

Half-equation for the oxidation of Cl^- to Cl_2

Half-equation for the reduction of ClO_3^- to Cl_2

Overall equation

(3)

- (d) Give the equation for the reaction of solid sodium chloride with concentrated sulfuric acid.

State the role of the chloride ions in this reaction.

Equation

Role _____

(2)

- (e) Draw the shape of the Cl_3^- ion.

Include any lone pairs of electrons that influence the shape.

(1)

- (f) Chlorine forms an ion with the Group 3 element thallium (Tl).

State and explain the bond angle in TlCl_2^+

Bond angle _____

Explanation _____

(2)

(Total 10 marks)